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Title: What is beneath the surface? : comparing the product and process in L2 texts written by university students

Year: 2007

Version: Published version

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Please cite the original version:

Nordqvist Palviainen, Å. (2007). What is beneath the surface? : comparing the product and process in L2 texts written by university students. In O.-P. Salo, T. Nikula, & P. Kalaja (Eds.), *Kieli oppimisessa* (pp. 233-249). Suomen soveltavan kielitieteen yhdistys AFinLA. Suomen soveltavan kielitieteen yhdistyksen julkaisuja, 65. <https://journal.fi/afinlavk/article/view/59969>



WHAT IS BENEATH THE SURFACE? COMPARING THE PRODUCT AND PROCESS OF L2 TEXTS WRITTEN BY UNIVERSITY STUDENTS

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This article examines how far traditional methods of evaluating texts can benefit from analysis of the process of students' L2 writing. Twelve Finnish university students wrote a text in Swedish using a keystroke logging program which registered speed, pauses and revisions. The quality of the finished texts was evaluated by four experienced university teachers and then compared to the online measurements. The analysis showed that there were great individual differences between the writers and that there was no direct relation between the quality of texts as evaluated by teachers and the online measurements, i.e. the writing process. An analysis of the grammar revisions showed that only some of the grammatical structures that had been pointed out as problematic by the teachers were revised by the writers. Analyses of writing processes may have pedagogical implications, such as arranging teaching according to individual writing strategies and more effective grammar training.

Keywords: writing process, computer keystroke logging, teachers' evaluations, revisions

1 INTRODUCTION

Writing in a foreign language is a very good way of learning and reflecting over the language at hand. The writing of shorter and longer texts is indeed a fruitful and commonly used task used in foreign language teaching. It is easily administered in the classroom context. If the teacher reads the written product, he or she will be able to give feedback to the student as well as getting own feedback on how successful their teaching is. Moreover, on the basis of the written product the teacher will be able to evaluate and grade the student's skills. However, a didactic problem with this approach is that the teacher will know very little about the actual writing process, i.e. *how* the student worked with the text and the language issues that might have caused problems up until the finished product and what writing strategies were used: "... although two writers' final texts composed under identical conditions may be similar in quality and structure, the processes behind the creation of these texts could have included significant differences in terms of pause and revision behaviour." (Lindgren & Sullivan 2006a: 31–32.) From the perspective of foreign language teaching it is of potential value to learn more about individual strategies and what a particular student seems to struggle with, e.g. concerning grammar.

The possibilities of and interest in studying the writing process have increased during the last couple of decades since technology has facilitated the examination of the process in a more detailed fashion, e.g. by using computer keystroke logging techniques (see section 2 below). So far, little research has been carried out on using keystroke logging techniques as a teaching tool (see however Lindgren 2005), but there are likely many possible pedagogical applications. This article focuses on the added value of analyzing the process of students' L2 writing in addition to traditional evaluation methods of a written product. More specifically, it will examine how well the evaluations of experienced teachers match what can be discovered by using methods of analyzing online writing.

In the following section 2, research on the writing process is reported. In section 3, data and methods of the study are introduced, followed by the results of the analyses in section 4. The chapter is concluded by a discussion about the results and pedagogical implications.

2 STUDYING THE WRITING PROCESS

Much attention has been placed on studying cognitive aspects of writing since the early 1980s (Gregg & Steinberg 1980) and think-aloud protocols (e.g. Flower & Hayes 1981), retrospective interviews (e.g. Greene & Higgins 1994) and video recordings (Matsuhashi 1982) have been used as methods. As computer technologies have developed, a number of keystroke logging programs have been launched (e.g. JEdit (Cederlund & Severinson Eklundh n.d.), ScriptLog (Strömqvist & Karlsson 2001), Inputlog (Leijten & Van Waes 2004). The programs are like word processors but register all the activities that take place during writing (e.g., pauses, deletions, speed changes, movements). These programs also include the option to re-play the writing session, rather like using a tape recorder to record speech. Detailed information is then given on the writing session, which in a way reflects the mental activities that have transpired during the writing, such as processes of planning, translating and revising.

Writing in a second or foreign language is a complex task in that it not only involves text generation, but also finding the appropriate lexicon and syntax for the ideas that are to be expressed. Studies of the writing process of L2 writers have shown that they have a similar surface level focus to that of young and inexperienced L1 writers (e.g. Bereiter & Scardamalia 1987) and that they restrict their attention to the linguistic demands of writing more frequently than L1 writers (e.g. Broekkamp & Van den Bergh 1996). This may result in a focus on issues of form such as grammar structures,

vocabulary and spelling at the expense of content, text structure and coherence.

The revising of a text is an interesting aspect to study since it reflects mental activity and meta-linguistic awareness (Allal, Chanquoy & Largy 2004). Silva (1993) and Thorson (2000) have shown that writers in L2 revise more frequently than writers in L1. Revision means, according to Fitzgerald (1987: 484), “making any changes at any point in the writing process”, and these may include deletion, substitution or insertion of items (e.g. letters, words or pieces of text). Revisions may be either internal, i.e., they take place only in the mental representation of the text, or external, i.e., they entail visible changes to the text (Lindgren & Sullivan 2006a). The internal revisions are difficult to capture, since they are not visible to the reader but remain in the writer’s mind. Revisions of externalized text may include correction of surface elements, such as spelling or grammar, meaning-related revisions that concern the content of the text, or changes of style and audience. Typically, these kinds of revisions are not visible to the reader of a finished text unless concrete markings are left in the text, such as crossing-out in a text written by hand. However, by using computer keystroke logging techniques it is possible to trace revisions of externalized text. From the point of view of foreign language teaching and learning, examining revisions may yield valuable information on the learning and writing process (Lindgren 2005).

The following study was designed so that keystroke logged texts written by university students writing in a foreign language (Swedish) were analyzed from two different perspectives: four experienced teachers evaluated the final texts (the products) and the researcher made online analyses of the texts (the processes). The main research question is: To what extent do the evaluations of the teachers match the analyses of the online data in aspects such as speed of writing, pause behaviour and the processing of grammar? In other words, are there any aspects that are not visible in the finished texts, but are revealed by analyses of process data?

3 THE STUDY

3.1 SUBJECTS AND DATA COLLECTION

Twelve female university students with Finnish as their L1 and psychology as their major attended a compulsory course in Swedish (*Akademisk svenska*)¹. They had all studied Swedish from primary school to upper secondary school, (about 6 years). For the study they watched a TV programme about ADHD², in which a host interviewed a young woman with ADHD, two parents of children with ADHD and a psychiatrist. The programme was in Swedish and lasted for 30 minutes. Immediately after the programme the students were told to summarize its contents, writing on a computer. The writing session lasted for about 40 minutes and the texts were written on a computer using the ScriptLog program.

3.2 TEACHERS' EVALUATIONS

Four experienced university teachers of Swedish, to whom the students were unknown, participated in the study. The teachers were asked to read six texts each and to fill out a questionnaire for each text. Thus, each text was evaluated by two different teachers. The questionnaire was divided into two parts. In the first part, A, they were asked in open-ended questions to comment on six issues: *general impression of the text, fluency/readability, vocabulary, grammar structures, problematic aspects of the text and what kind*

1 Finland is a bilingual country (Finnish – Swedish) and since 1968, all pupils in Finland study the second national language in school, usually starting at grade 7 (at thirteen years of age). Children in Finnish-speaking schools thus study Swedish. At the university level, all students are required to attend a compulsory course (or to pass an examination) that establishes that the student has acquired a certain level of skills that in the second national language corresponds to at least level B1 on the CEF-scale (the Common European Framework of Reference of Languages). At the University of Jyväskylä, which is a Finnish-speaking university, this compulsory course is called *Akademisk svenska* (Academic Swedish), and comprises 2-4 ECTS credits.

2 Attention Deficit Hyperactivity Disorder.

of feedback should be given to the student. In the second part, B, the teachers were asked on the basis of the text to say what kind of impression they had of the writer and her writing process in this particular text. They could choose one or more of the following words: *fast – slow, careful – sloppy, confident – uncertain, fluent – non-fluent, and often makes pauses – rarely makes pauses.* The questionnaire was answered in writing, and the teachers were also encouraged to make comments on the student's written text itself, if necessary.

In order to facilitate the presentation of the results, the texts were divided into three groups corresponding to their general quality: high quality (n=4), average quality (n=4) and low quality (n=4). The groupings were made by the researcher, on the basis of the teachers' written evaluations (part A of the questionnaire). In the high quality (HQ) texts, the teachers commented that the texts were very fluent, very readable, interesting, detailed and well-structured. Vocabulary was also generally good and varied and although there were grammatical errors, they did not disturb the reading to any significant extent. The teachers regarded the low quality (LQ) texts as having low fluency, many spelling and grammar errors that disturbed reading, and containing unvaried or imprecise vocabulary.

3.3 ANALYSES OF THE ONLINE DATA

The data were collected using the computer keystroke logging program ScriptLog. ScriptLog records the writing activity and afterwards it is possible to play back the recording in real time and to perform a wide range of analyses on it, e.g. on pause patterns, revisions and speed. For purpose of this study, figures on text length, typing speed and pausing time were generated. The typing speed was measured by *Mean Transition Time (MTT)*, i.e. the average time between pressing the keys on the keyboard. Thus, the lower the MTT-score, the faster the typist was. The time spent on pauses was measured by calculating the proportion of time spent

on inactivity longer than 5 seconds in relation to the total time of the writing session. The higher this percentage, the more time was spent on pausing and not typing. These measurements were used to compare the teachers' evaluations of the texts with the online measures. The results are reported in section 4.1.

In addition, a revision analysis was done. Externalized revisions (see section 2) can be traced in ScriptLog by analyzing the playback recordings and by using an analysis option that collects all deletions made in a text. Only external revisions that were preceded by a deletion were included in the analysis and coded for. The taxonomy used for coding was adapted from Lindgren & Sullivan (2006b). A first distinction was made between *pre-contextual* and *contextual revisions*. Pre-contextual revisions are made at the point of inscription (Matsuhashi 1987), whereas contextual revisions are undertaken when writers move away from the point of inscription and revise already written text.³ The revisions were further divided into *form revisions* (*typography, spelling, grammar, punctuation and format, meaning-preserving revisions*) and *conceptual revisions* (*text-based, micro-structure, macro-structure, balance, topic, audience*).

The analysis in this study focused on revisions of grammar. The grammar revisions were coded into *parts of speech, article and agreement* (following Lindgren & Sullivan 2006b), in addition to the category *word order*.⁴ A code was also used to register whether

3 The Lindgren & Sullivan taxonomy was developed only for contextual revisions, but in the study reported here, it was also applied to pre-contextual revisions.

4 Finnish is a Fenno-Ugric language whereas Swedish is a Germanic language and there are certain Swedish grammar structures that are difficult for Finnish speakers to acquire. Swedish as well as Finnish are SVO-languages. However, the word order in Swedish is sometimes inverted (in questions, subordinate clauses and sometimes in main clauses, e.g. when an adverbial is placed first in a sentence). Another peculiarity in Swedish grammar is agreement, e.g. in nominal clauses: *en röd hund* ("a red dog") – *den röda hunden* ("the red dog"). The fact that the system for definiteness vs indefiniteness in Finnish is different from Swedish adds to the problem, and Finnish-speaking students often have problems in producing these kinds of structures.

the revisions ended up correctly, or incorrectly. The aim of this type of analysis was to find out whether the students were revising the type of grammatical structures which the teachers had previously pointed out as problematic, or if the revisions were devoted to other types of structures. Results are reported in section 4.2.

4 RESULTS

The number of revisions and the speed of typing show great variation among the 12 writers (see figure 1). The fastest typist, Ida, had a mean transition time of 0.158 seconds whereas Essi, the slowest typist, showed a mean score of 0.375 seconds. As far as the number of revisions is concerned, Clara made 235 revisions whereas Nina made only 62.

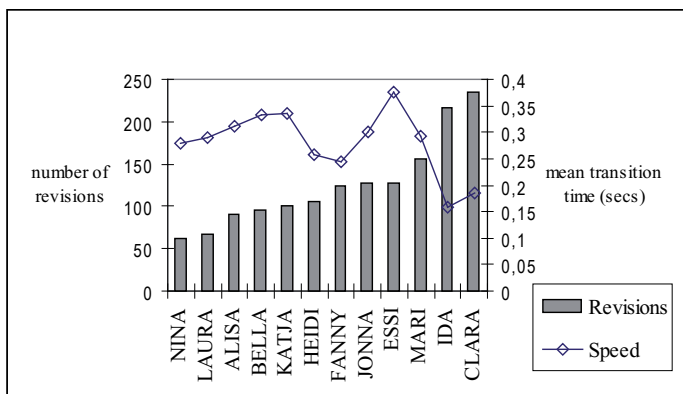


FIGURE 1. Number of revisions (deletion+revision) and speed of typing (mean transition time, i.e. average time between pressing the keys) in the texts of 12 subjects.

In sections 4.1 and 4.2 below, a more careful analysis of the writers of the HQ-texts (Ida, Bella, Laura and Fanny) and the LQ-texts (Essi, Heidi, Jonna and Katja) is presented. More specifically, in 4.1 the question of what relation there is between the teachers'

evaluations based on the finished texts on the one hand, and online measures of speed, pausing time and number of revisions on the other, will be examined. In section 4.2, the grammatical problems as pointed out by the teachers in the texts will be compared to the actual measured revisions of grammar that the subjects made.

4.1 TEACHERS' EVALUATIONS VS. ONLINE MEASURES

In the HQ-writers group, Bella's text was evaluated as being fluent and easy to read. The online measures in table 1 show that Bella was a fairly slow typist (MTT 0.332), had a high pausing time (52%) and made few revisions (n=96). Moreover, the text was short (1490 tokens). The online measures indicate that Bella was a careful and slow writer, planning before writing and/or rereading the already produced text.

TABLE 1. Online measures of Text length, Pausing time, Speed and Number of revisions in 4 HQ-texts and 4 LQ-texts.

	QUALITY OF TEXT (HQ = high LQ = low)	TEXT LENGTH (tokens in final text)	PAUSING TIME (>5 secs)	SPEED (Mean Transition Time, secs)	NUMBER OF REVISIONS
Bella	<i>HQ</i>	1490	52%	0.332	96
Fanny	<i>HQ</i>	2542	38%	0.244	124
Ida	<i>HQ</i>	2570	44%	0.158	218
Laura	<i>HQ</i>	2032	53%	0.289	67
Essi	<i>LQ</i>	976	40%	0.375	128
Heidi	<i>LQ</i>	2540	42%	0.258	105
Jonna	<i>LQ</i>	1772	46%	0.302	127
Katja	<i>LQ</i>	1728	40%	0.335	101

Fanny and Ida, in contrast, were fast writers (MTT 0.244 and 0.158), paused relatively rarely (38% and 44%), made many revisions (n=124 and 218) and wrote long texts (2542 and 2570 tokens). They thus produced a considerable amount of text and the measures indicate them planning, reading and revising the text during their

writing. The teachers evaluated these two texts as fluent, and Ida's text was even considered comprehensive. Laura's text was relatively long (2032 tokens), the speed was relatively slow (MTT 0.289) and pausing time high (53%). Like Bella, Laura seemed to be a slow and thoughtful writer. Notably, revisions were very rare (n=67). One of the teachers wrote a comment on Laura's text that "the text is surprisingly fluent and comprehensive, despite the fact that there are several morphological and syntactical errors". As will be further discussed in section 4.2, several grammatical errors thus remained in the text and were not revised by the writer.

Essi, a LQ-writer, was the slowest typist of all eight subjects (MTT 0.375) and wrote the shortest piece of text (976 tokens). At the same time, she had the lowest pausing time (40%) and made many revisions (n=128). The teachers commented that there was little fluency in the text and a considerable number of many grammatical errors which made the text difficult to read. Hence, although the writer wrote slowly and revised frequently, many errors remained and made the final text problematic to read. Heidi's writing profile differed from Essi's, in the sense that she was clearly a faster typist (MTT 0.258) and wrote a much longer text (2540 tokens). However, the teachers' evaluations of the two texts were similar. The texts were considered to be non-fluent and difficult to read because of an abundance of grammatical and spelling errors. Jonna and Katja had about the same writing speed (MTT 0.302 and 0.335) and the final texts were of similar length (1772 and 1728 tokens). However, Jonna had a higher pausing time than Katja (46% vs. 40%) and made more revisions (n=127 vs. 101). These differences suggest that Jonna was planning and elaborating the text in a different way than Katja. The texts were also evaluated slightly differently; both texts were evaluated by the teachers as poor and non-fluent, but Jonna's text was commented as simple and consisting of only short main clauses, whereas the many errors in Katja's text made it difficult to follow and understand.

The teachers generally agreed on the characteristics that they attributed to the writers. The writers of the HQ-texts were

considered to be *fluent*, *confident* and *careful*, whereas the writers of the LQ-texts were judged to be either *uncertain* or *sloppy*. There were also individual differences within each group, so that in the HQ-text group, Bella and Laura were seen as *slow writers*, whereas Ida was considered a *fast writer*. Moreover, Bella was judged to be *often making pauses*, and Fanny, Ida and Laura *rarely making pauses*. Relating these judgments to Speed (MTT) and Pausing time, they match surprisingly well; by way of example, Bella had a high MTT-value and pausing time whereas Ida scored low on both measures. An interview with the teachers would have shed more light on why and how these judgments were given on the basis of the texts.

For both groups, but especially for the better group, the different writers and their writing processes varied considerably: There were slow writers and fast writers, they produced short as well as long texts, they varied in how many revisions they made and in how much time they spent on pauses. Thus, although the final product reached a similar level of quality in each group, the production process varied considerably. In other words, there was no direct connection between text length, writing speed, pausing time and number of revisions on the one hand and quality of text (as evaluated by the teachers) on the other.

4.2 TEACHERS' EVALUATIONS VS. REVISIONS OF GRAMMAR

The total number of revisions (see table 1) varied from one writer to another and there were no specific correlations to the quality of the text. However, there was one clear difference between the groups – the number of grammatical revisions. The authors of the HQ-texts devoted between 1 and 9% of their revisions to correction of grammar structures, whereas the authors of the LQ-texts revised grammatical structures in 11–18% of the cases.

When reading the HQ-texts, the teachers generally found few grammatical problems. However, they did mention that there were

many agreement errors in Ida's final text. Ida made twenty grammar revisions and all but two were correct after revision. It seems as if Ida did not pay much attention to agreement in her writing, since a total of only four revisions of this type were found. She thus left most of them unattended. On this other hand, she did correct word order errors. Word order was not seen as a problem by the teachers, which means that she revised them so that they ended up correct. Turning to Bella, one of the teachers thought that she had problems with prepositions. Out of the seven grammar revisions in total, none concerned prepositions. While the revision analysis does not reveal anything about internal revisions, i.e. whether Bella was actually reflecting on the choice of prepositions, external revisions showed no sign of such reflection. According to the teachers, Laura's biggest problem was word order in subordinate clauses. The revision analysis showed that she did not do any revision involving word order. Instead, she did four revisions on agreement. This shows that she focused more on agreement than word order, and from a didactic point of view it would perhaps be worthwhile to point out word order rules to her. Finally, Fanny had, according to the teachers, problems with word order and agreement structures. She corrected a couple of word order errors but no agreement errors.

Turning to the LQ-writers, the teachers regarded Essi as having major problems with grammar structures generally, and word order and agreement in particular. She made several revisions of agreement structures, sometimes leading to a correct form, sometimes not, but not a single revision of word order. According to the teachers, Heidi had the same type of problems as Essi, i.e. with word order and agreement. In addition, she made errors in noun and verb inflection and definiteness (nouns). Her grammar revisions constituted almost one fifth (18%) of all her revisions, and most of them concerned word order, verb inflection and pronouns, and in about half of the cases the revisions resulted in correct forms. However, no corrections were made in relation to agreement errors. Thus, Essi as well as Heidi made errors

of agreement and word order, but Essi revised only word order structures and Heidi focused on agreement structures. Essi and Heidi also differed in writing strategies in that Heidi made quite a few contextual revisions (she thus re-read and revised what she had written earlier in the text), whereas Essi made the majority of the revisions precontextually (i.e. at the point of inscription).

The teachers noticed Jonna's many errors in agreement structures and the use of articles. About half of her revisions indeed concerned agreement and they all resulted in the correct form. Despite this, many agreement errors remained in the text. There was only one revision connected to articles and her other revisions concerned pronouns and verbs. Katja had problems with word order and agreement as well as the use of the infinitive. The revision analysis showed that Katja did revise incorrect word order and verb inflections but only in some cases produced the correct forms. Others ended up incorrect. However, she did not revise any agreement errors.

In many cases, there were thus correspondences between the grammar problems detected by the teachers (in the product), and what the writers were working on and revising (in the process). However, there were also plenty of cases where the teachers pointed out grammar problems in the texts that the writers had not focused on. By way of example, the teachers found word order and agreement to cause problems in texts produced by Essi, Katja, Fanny and Heidi, but whereas Essi made only revisions on agreement, Katja, Fanny and Heidi focused solely on word order. The contrary was also true, i.e. that the writers revised aspects that were not pointed out by the teachers as problematic in the final text (see Laura and Ida above).

Finally, there was a slight tendency for the LQ-text writers to make more contextual revisions than the HQ writing peers, i.e., they re-read already written text and made revisions afterwards. Conceptual revisions, on the other hand, were more frequently made by the HQ-text group of writers. It would thus seem as though the less confident a writer is in a second language, the more likely

he or she is to concentrate on issues of form rather than conceptual content.

5 DISCUSSION

This study showed that there was great variation between the writers and their writing processes in terms of e.g. pause and revision behaviour, irrespective of the quality of the final text. These findings can have certain pedagogical implications for the teaching of writing in a foreign language. In spite of recent trends such as communicative emphasis, there may still be a strong tradition of focusing on formal aspects of language in teaching. Focus on form might lead to teaching that groups students based on how advanced they are in these matters. One pedagogical possibility is to focus on individual writing styles and strategies rather than knowledge of grammar. A writer with poor skills and a more proficient writer may have similar writing strategies, e.g. concentrating more on content than on form, or writing slowly and reflecting a lot. They could perhaps benefit from other types of teaching methods than those suitable for peers who, for example, are fasttypers and rarely stop and to revise on a precontextual level.

Many of the comments made by the teachers were about grammatical errors and the extent to which they disturbed the reader and understanding of the text. To some extent this reflects the weight that is traditionally put on grammar in foreign language teaching. Writers who had only a few grammatical errors in their texts were consequently considered to be *fluent*, *confident* and *careful*, whereas writers of texts with many errors were perceived as either *uncertain* or *sloppy*. The former group of writers made only a few revisions of grammar, whereas the latter group made many more. In this sense, the poorer writers not only had more errors left in the text, but they also devoted more time to revisions of grammar. They thus seemed to be aware that they had problems with grammar and were concentrating on this. This focus on formal

issues at the expense of content and overall structure has been shown to be typical of children's writing (Bereiter & Scardamalia 1987), second-language writers (Broekkamp & van den Bergh 1996) and people with reading and writing difficulties (Wengelin 2002).

Analysis of the online data showed that writers often focus on certain grammar structures and ignoring others when making revisions. It is likely that the writer focuses on structures which they know are problematic, or which they think are important, or on structures for which the grammar rules are of current focus (e.g. that have been taught during the course). Cognitively, it is also more economical and efficient to focus on one rather than many different types of structures at the same time. This may be one reason why some incorrect structures are ignored, or at least not revised. However, the reason for this can only be a matter of speculation, since we can only analyze the external revisions. It may well be that the writer has considered the structures internally and chosen a certain (incorrect) form. The intentions behind revisions are, in fact, impossible to capture without interviewing the writer about them. This is a disadvantage and limitation of using only the keystroke logging technique.

From the pedagogical point of view it is of importance to consider not only what *was* focused on (in terms of external revisions) by the writer, but also what was *not* focused on (in terms of external revisions). If there is a text with many errors of agreement as well as word order, but the revision analysis shows that only agreement was a matter of concern to the writer, how should the teacher approach this student? Probably the best way would be to start by instructing, discussing and practising the rules of agreement, since the number of revisions on agreement structures indicate that this is of current interest to the student. After this, the other problematic area, word order, might be introduced and made known to the student.

6 CONCLUSION

Studying the writing process by means of computer keystroke logging techniques may be useful in the teaching of foreign languages. In this study, the texts were recorded primarily for the purpose of research, but the same type of procedure could be carried out by a language teacher in order to increase learners' awareness of writing strategies and the language learning process. Lindgren (2005) has combined keystroke logging with stimulated recall in order to involve the student in the learning process. By these methods, the student, together with the teacher and/or a peer, looks at her/his own recording after a writing session. They discuss the writing process together and the student has the opportunity to describe and explain why he or she made a revision or paused. In addition to increased awareness about her/his own process, the student also gets immediate feedback from the teacher. Indeed, in the future a combination of methods is likely to be the best way to learn more about writing processes in teaching as well as research (Wengelin et al 2005).

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